Title: SPEED CHANGE GEAR FOR
AUTOMATIC TRANSMISSION
Inventor(s): Wataru ISHIMARU
DOCKET NO.: 088473-0137

Fig. 1

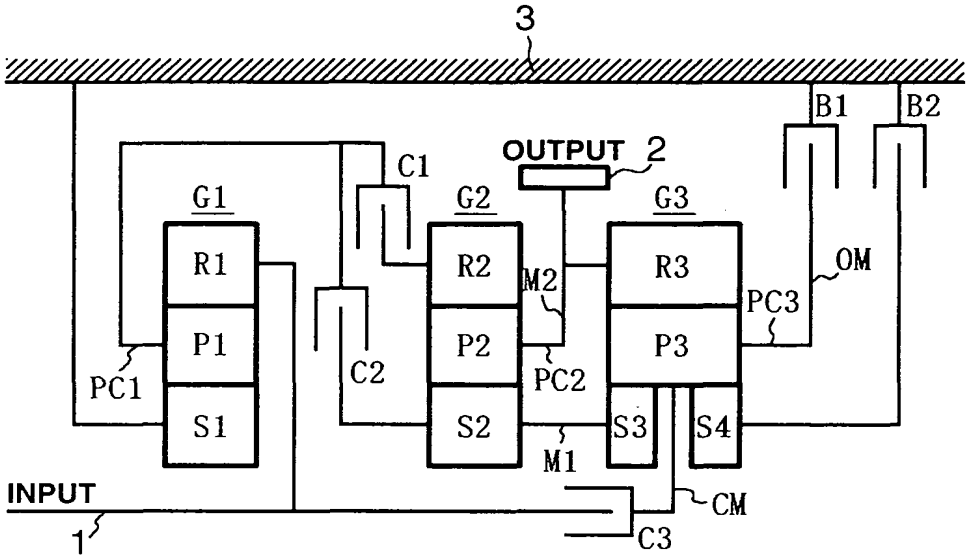


Fig. 2

GEAR SHIFT \ FRICTION ELEMENT		C1	C2	C3	B1	B2	5.5	6.0	6.5	7.0
FORWARD	FIRST GEAR	○			○		4.060	4.260	4.583	4.782
	SECOND GEAR	○				○	2.192	2.360	2.500	2.773
	THIRD GEAR	○	○				1.538	1.600	1.677	1.818
	FOURTH GEAR	○		○			1.153	1.164	1.170	1.205
	FIFTH GEAR		○	○			0.891	0.870	0.862	0.824
	SIXTH GEAR			○		○	0.741	0.714	0.714	0.678
REVERSE GEAR			○		○		4.396	4.000	4.167	3.828
						α1	0.350	0.375	0.400	0.450
						α2	0.350	0.400	0.400	0.475
						α3	0.425	0.475	0.500	0.525

Fig. 3

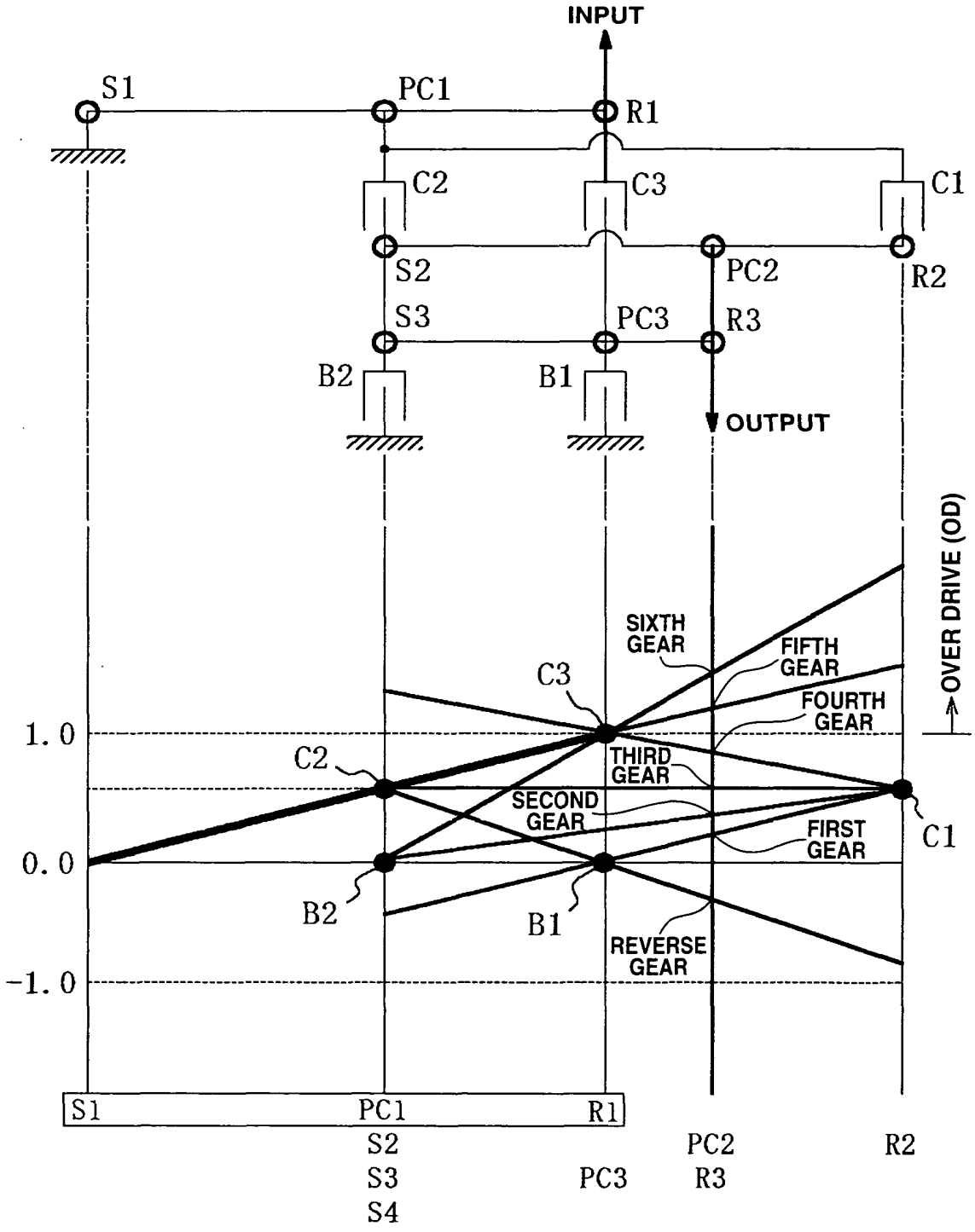

INPUT
S1
PC1
R1
C2
C3
C1
S2
PC2
R2
S3
PC3
R3
B2
B1
OUTPUT
OVER DRIVE (OD)
SIXTH GEAR
FIFTH GEAR
FOURTH GEAR
THIRD GEAR
SECOND GEAR
FIRST GEAR
REVERSE GEAR
1.0
0.0
-1.0
S1
PC1
R1
S2
S3
S4
PC3
PC2
R3
R2

Fig. 4(a)

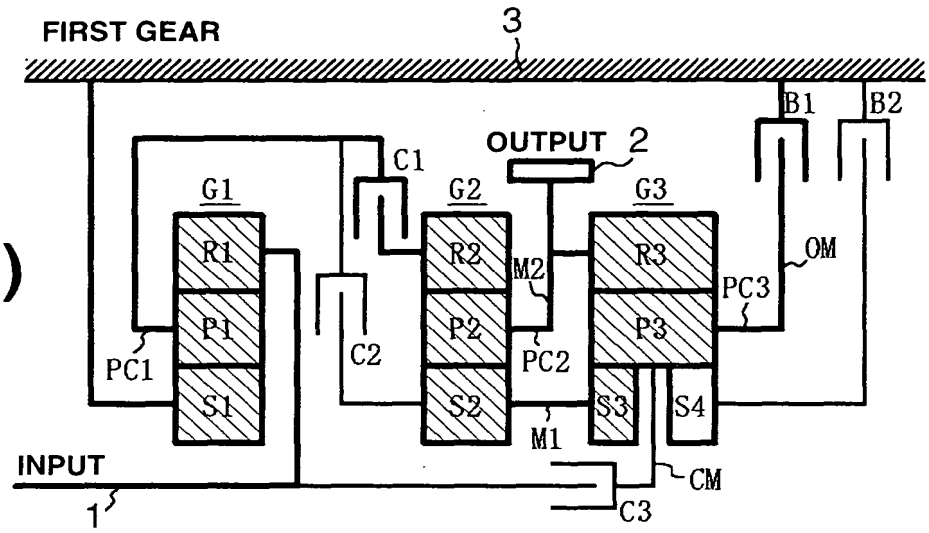


Fig. 4(b)

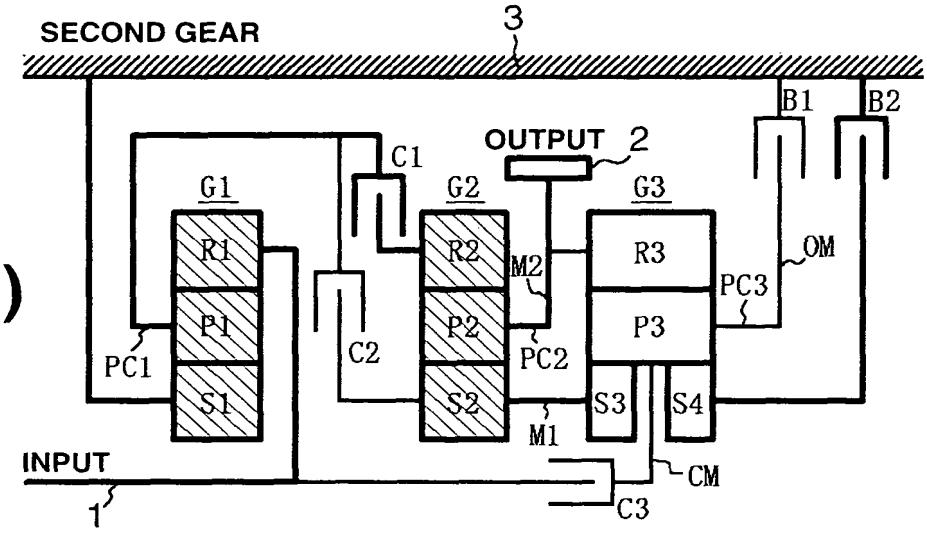


Fig. 4(c)

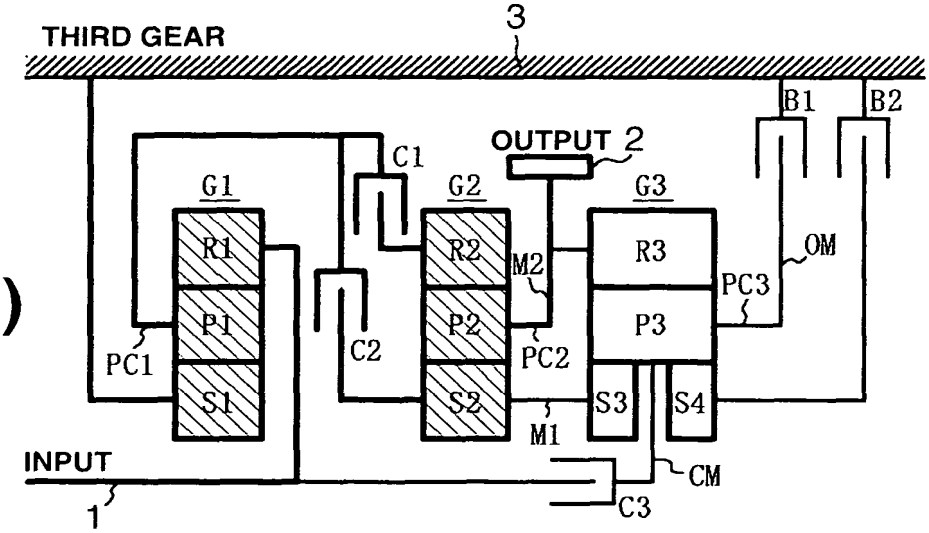


Fig. 5(a)

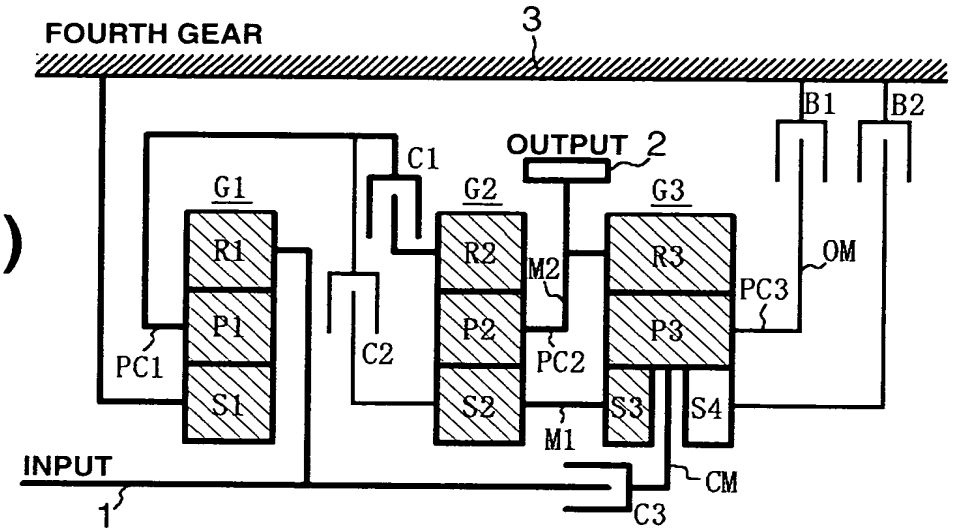


Fig. 5(b)

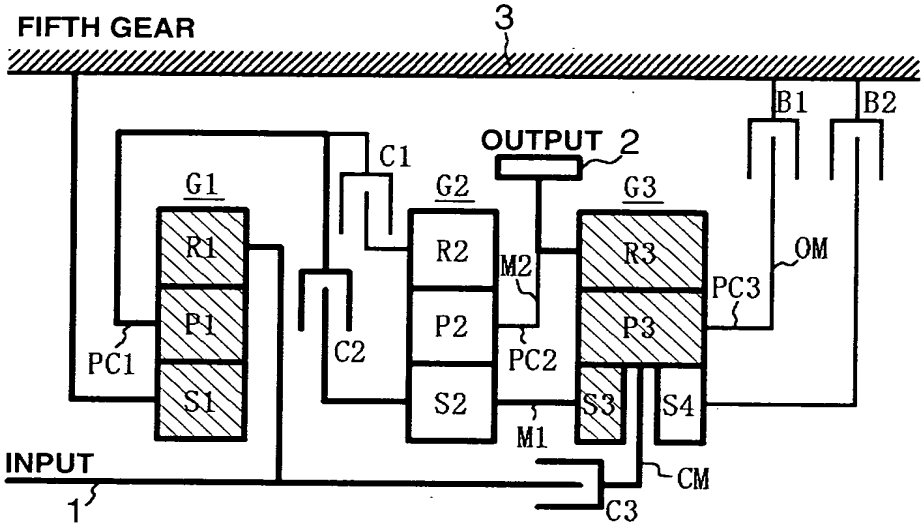


Fig. 5(c)

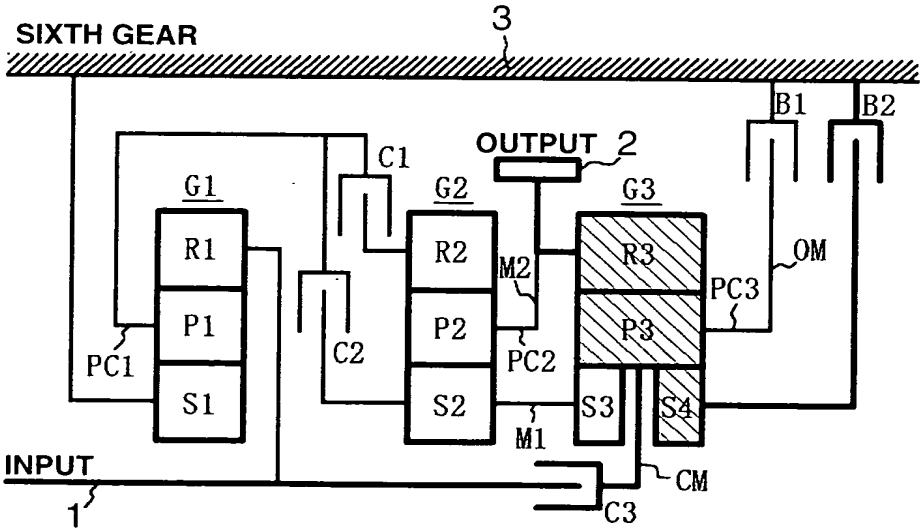


Fig. 6

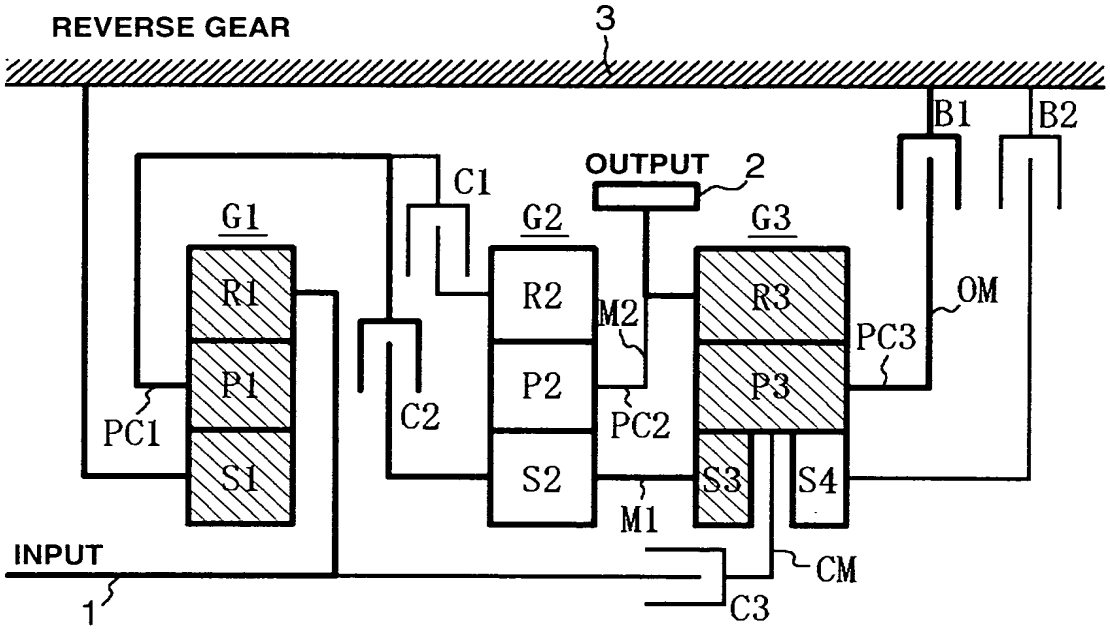

REVERSE GEAR
3
B1
B2
C1
OUTPUT
2
G1
G2
G3
R1
R2
R3
OM
M2
PC3
P1
P2
P3
PC1
C2
PC2
S1
S2
S3
S4
M1
INPUT
CM
1
C3

Fig. 7

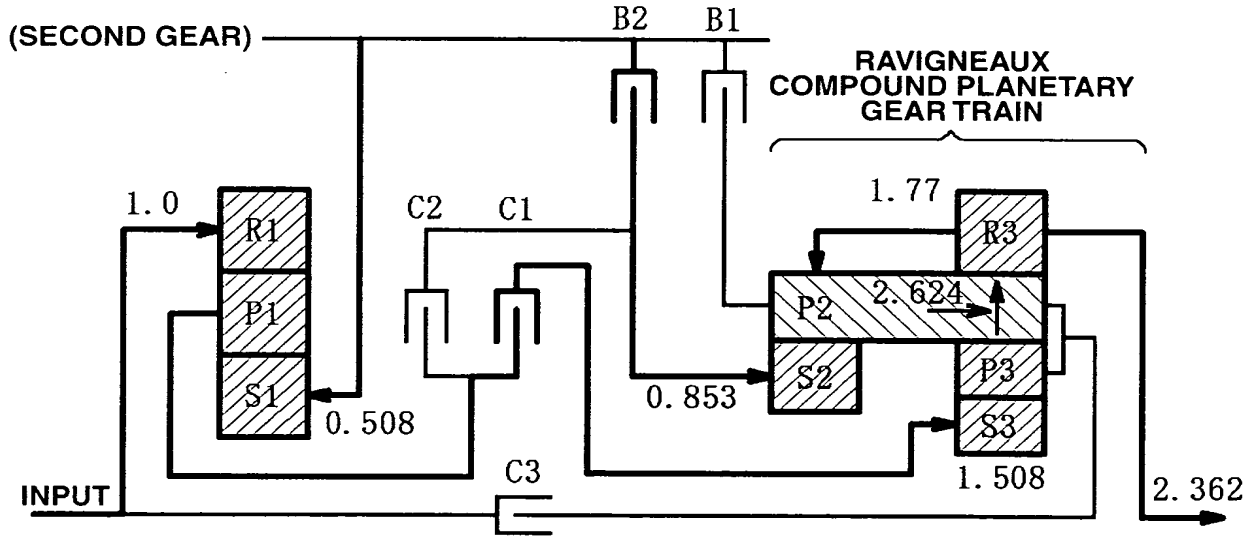

(SECOND GEAR)
B2
B1
RAVIGNEAUX
COMPOUND PLANETARY
GEAR TRAIN
1.0
C2
C1
1.77
R1
R3
P1
2.624
P2
S1
0.508
0.853
S2
P3
S3
1.508
INPUT
C3
2.362

Fig. 8(a)

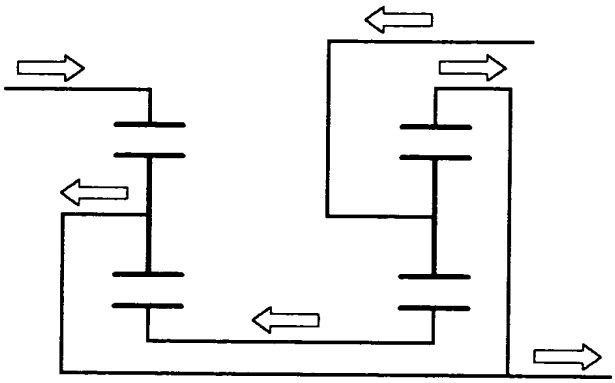


Fig. 8(b)

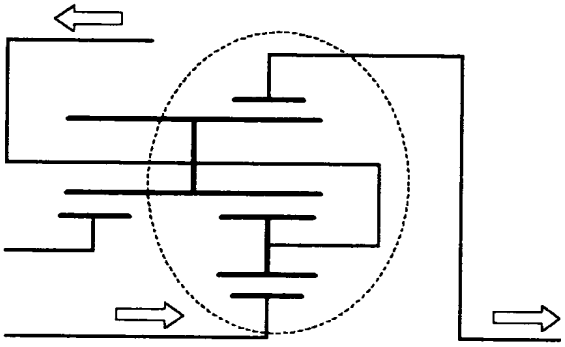


Fig.9

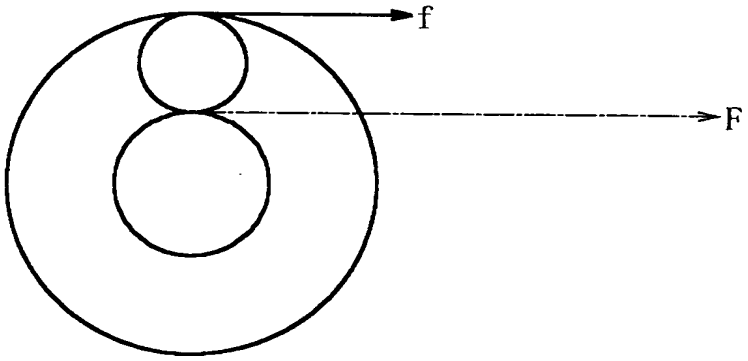


Fig. 10(a)

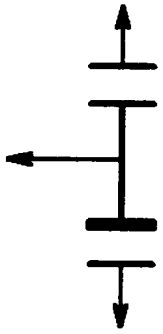


Fig. 10(b)

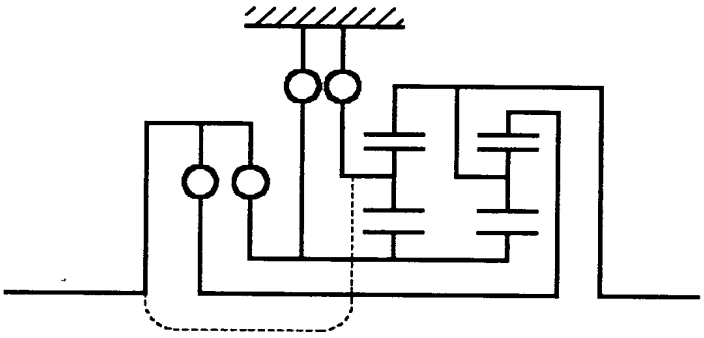


Fig. 10(c)

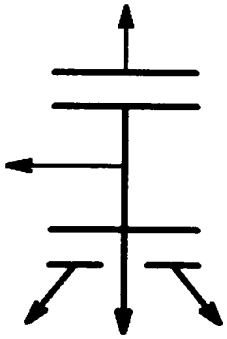


Fig. 11

		SIXTH GEAR					
		RATIO COVERAGE: 1			RATIO COVERAGE: 2		
			ISHIMARU PLANETARY GEAR TRAIN			ISHIMARU PLANETARY GEAR TRAIN	
		RAVIGNEAUX COMPOUND PLANETARY GEAR TRAIN	SPEED REDUCTION PLANETARY GEAR SET (DOUBLE PINION PLANETARY GEAR SET)	SPEED REDUCTION PLANETARY GEAR SET (SINGLE PINION PLANETARY GEAR SET)	RAVIGNEAUX COMPOUND PLANETARY GEAR TRAIN	SPEED REDUCTION PLANETARY GEAR SET (DOUBLE PINION PLANETARY GEAR SET)	SPEED REDUCTION PLANETARY GEAR SET (SINGLE PINION PLANETARY GEAR SET)
PLANETARY GEAR RATIO	α1	0.575	0.350	0.550	0.650	0.425	0.625
	α2	0.375	0.350	0.500	0.475	0.350	0.550
	α3	0.350	0.500	0.375	0.350	0.500	0.350
GEAR CHANGE RATIO	FIRST GEAR	4.500	4.505	4.392	4.714	5.093	5.072
	SECOND GEAR	2.373	2.308	2.325	2.637	2.609	2.519
	THIRD GEAR	1.575	1.538	1.550	1.650	1.739	1.625
	FOURTH GEAR	1.146	1.136	1.148	1.160	1.170	1.141
	FIFTH GEAR	0.880	0.891	0.883	0.842	0.872	0.881
	SIXTH GEAR	0.727	0.741	0.727	0.678	0.741	0.741
	REVERSE	4.200	4.395	4.133	3.474	4.969	4.634
INNER GEAR SHIFT RATIO	FIRST GEAR/ SECOND GEAR	1.896	1.952	1.889	1.788	1.952	2.013
	SECOND GEAR/ THIRD GEAR	1.507	1.501	1.500	1.598	1.500	1.550
	THIRD GEAR/ FOURTH GEAR	1.374	1.354	1.356	1.422	1.488	1.424
	FOURTH GEAR/ FIFTH GEAR	1.302	1.275	1.294	1.378	1.342	1.295
	FIFTH GEAR/ SIXTH GEAR	1.210	1.202	1.215	1.242	1.177	1.189
FORWARD TO REVERSE RATIO	REVERSE GEAR/ FIRST GEAR	0.933	0.976	0.941	0.737	0.976	0.914
TRANSMISSION EFFICIENCY	FIRST GEAR	0.968	0.969	0.974	0.968	0.989	0.974
	SECOND GEAR	0.950	0.968	0.972	0.952	0.968	0.972
	THIRD GEAR	0.993	0.988	0.993	0.993	0.988	0.993
	FOURTH GEAR	0.982	0.987	0.989	0.983	0.988	0.989
	FIFTH GEAR	0.989	0.988	0.989	0.989	0.989	0.990
	SIXTH GEAR	0.993	0.993	0.993	0.993	0.993	0.993
	SEVENTH GEAR						
	REVERSE	0.978	0.973	0.978	0.978	0.973	0.978
ENGAGEMENT ELEMENT TORQUE DISTRIBUTION	C1	1.575	1.203	1.550	1.650	1.175	1.625
	C2	1.575	1.538	1.550	1.650	1.739	1.625
	C3	1.209	1.538	1.214	1.243	1.739	1.190
	B1	5.775	0.769	5.683	5.124	0.909	6.268
	B2	0.798	5.934	0.775	0.987	6.708	0.894
	TOTAL	10.932	10.982	10.772	10.654	12.270	11.602
NUMBER OF ENGAGEMENT ELEMENTS INCREASED WITH OWC (ONE WAY CLUTCH)	OWC1	0	0	0	0	0	0
	OWC2	1	1	1	1	1	1
	OWC3	2	2	2	2	2	2
RATIO COVERAGE	MINIMUM	4.81	5.08	4.81	4.81	5.08	4.81
	MAXIMUM	7.20	9.02	7.80	7.20	9.02	7.80
DIRECT DRIVE MODE		NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE
SEVENTH GEAR RATIO		AVAILABLE	AVAILABLE	AVAILABLE	AVAILABLE	AVAILABLE	AVAILABLE

Fig. 12

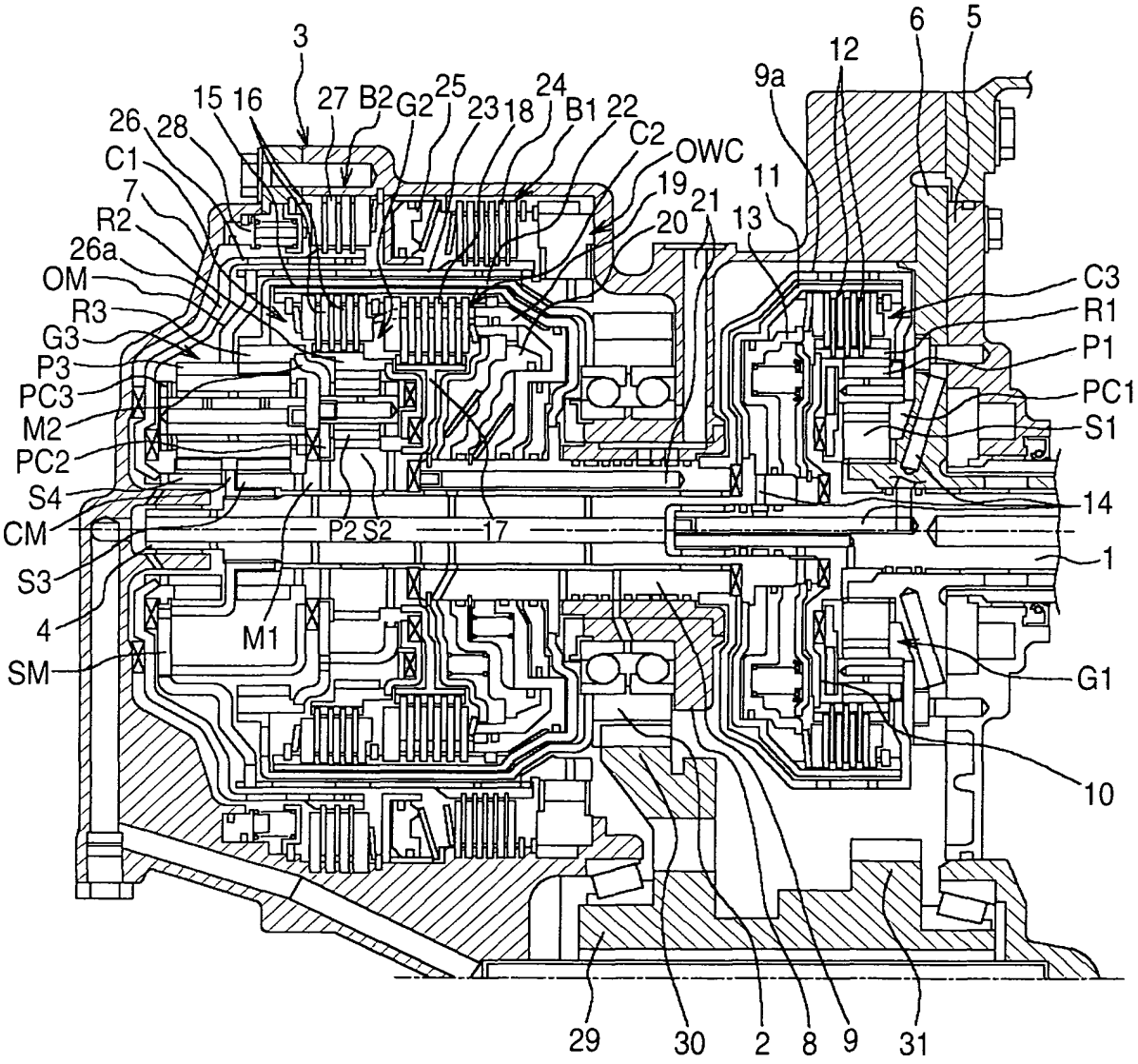

3
15
16
27
B2
G2
25
23
18
24
B1
22
C2
OWC
19
21
20
11
13
12
9a
6
5
26
28
C1
7
R2
26a
OM
R3
G3
P3
PC3
M2
PC2
S4
CM
S3
4
SM
M1
P2
S2
17
C3
R1
P1
PC1
S1
14
1
G1
10
29
30
2
8
9
31

Fig. 13

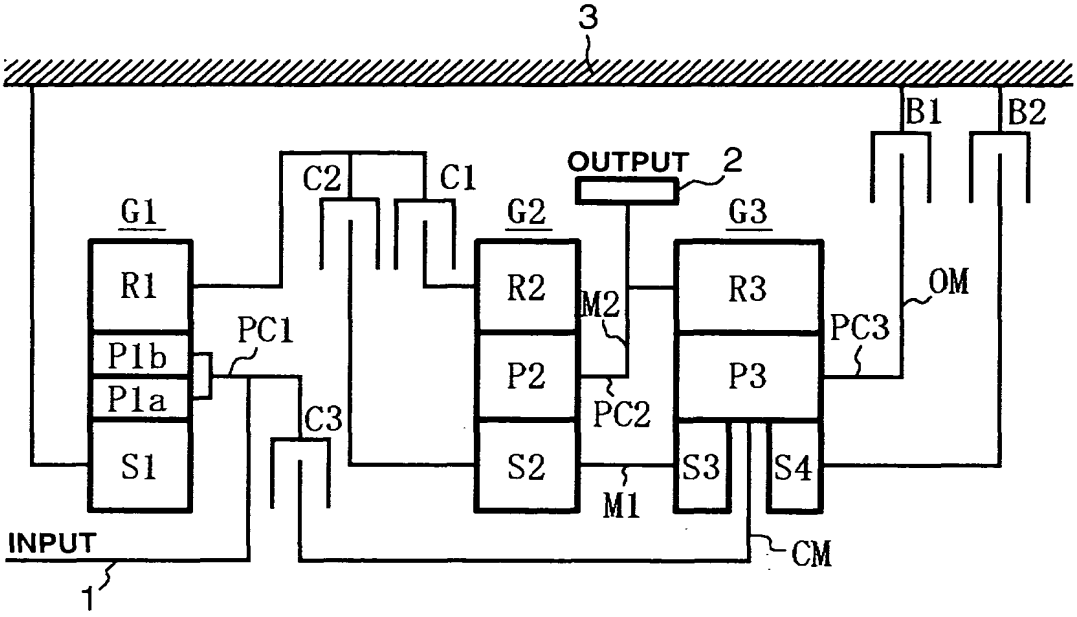

3
B1
B2
OUTPUT
2
C2
C1
G1
G2
G3
R1
R2
R3
OM
PC1
M2
PC3
P1b
P2
P3
P1a
C3
PC2
S1
S2
S3
S4
M1
INPUT
CM
1

Fig. 14

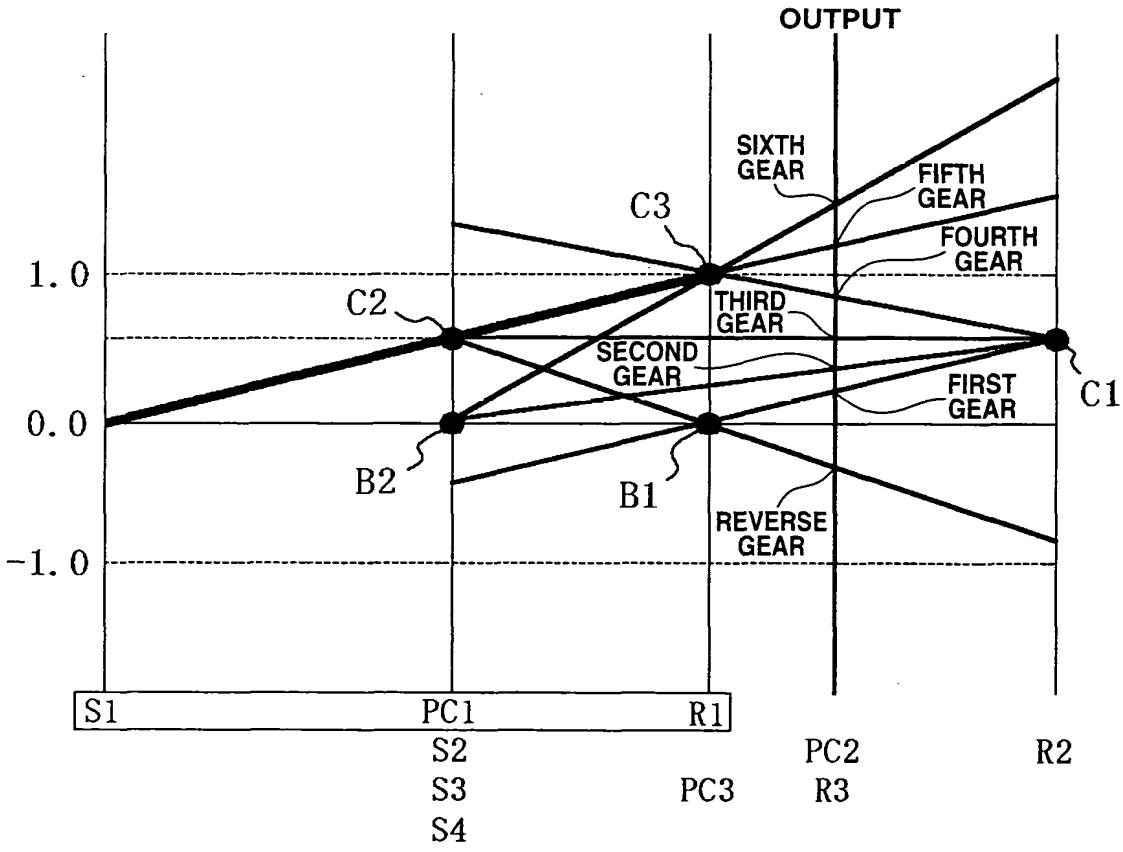

OUTPUT
SIXTH GEAR
FIFTH GEAR
C3
FOURTH GEAR
1.0
C2
THIRD GEAR
SECOND GEAR
FIRST GEAR
C1
0.0
B2
B1
REVERSE GEAR
-1.0
S1
PC1
R1
S2
S3
S4
PC2
R3
PC3
R2

Fig. 15(a)

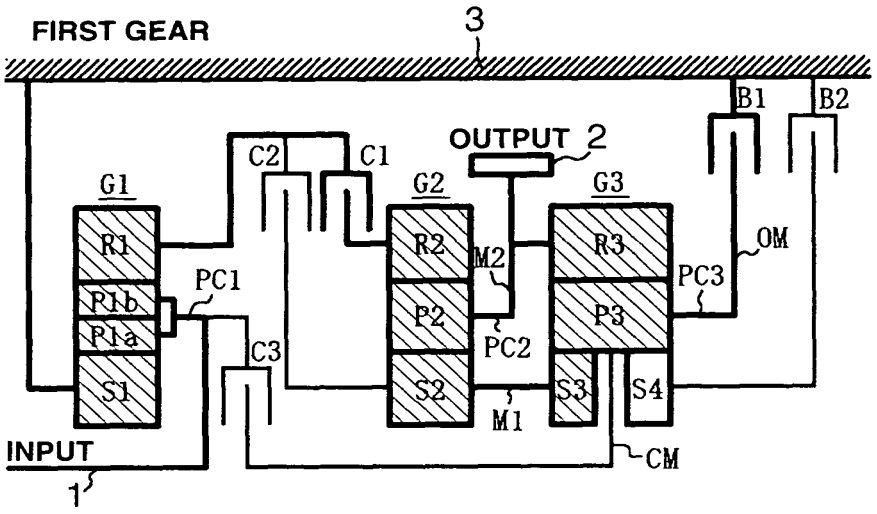


Fig. 15(b)

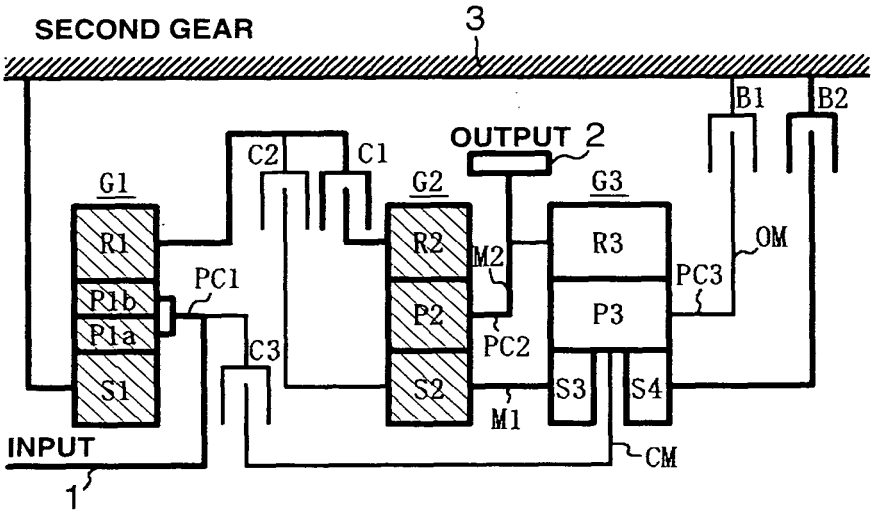


Fig. 15(c)

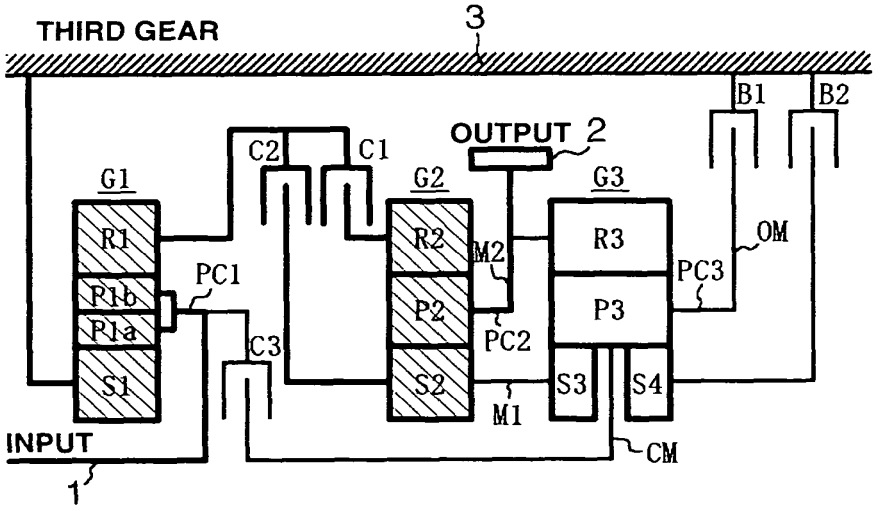


Fig. 16(a)

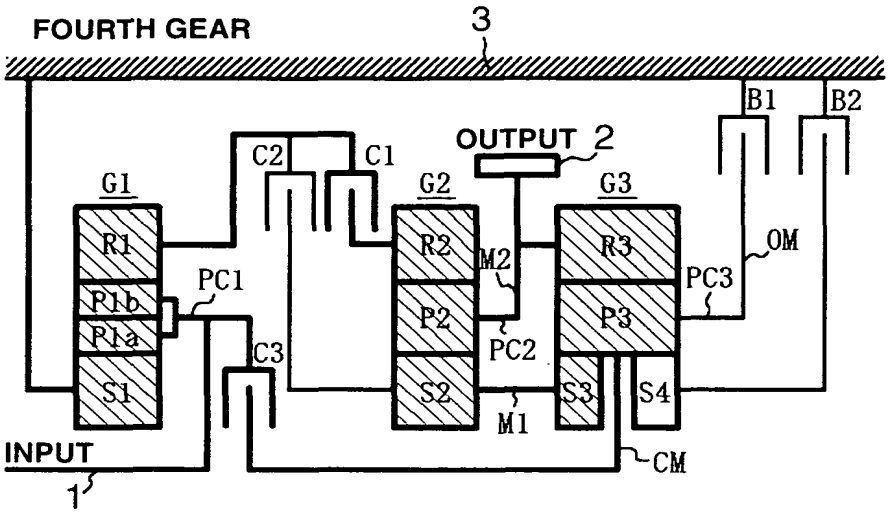


Fig. 16(b)

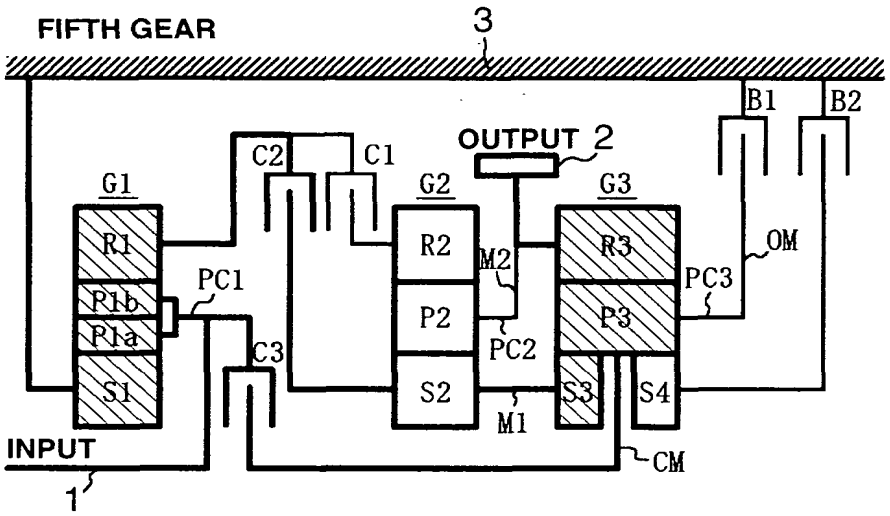


Fig. 16(c)

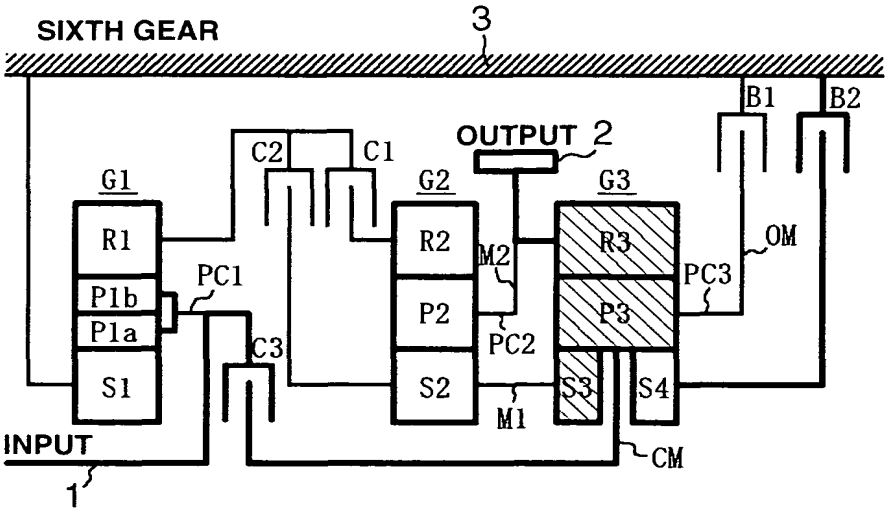


Fig. 17

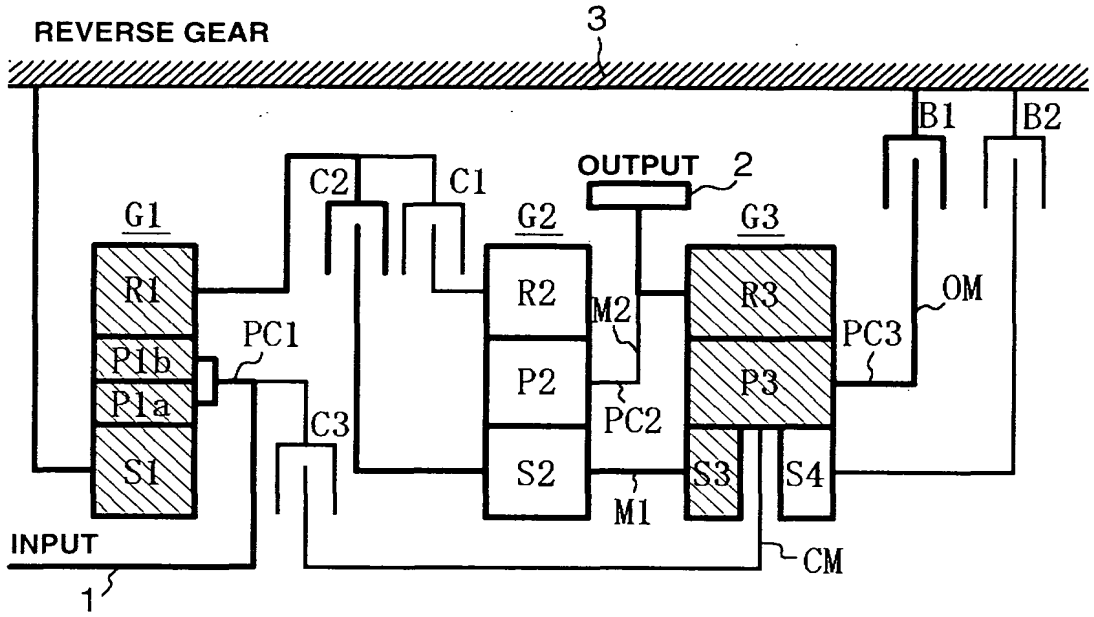

REVERSE GEAR
3
B1
B2
OUTPUT
2
C2
C1
G1
G2
G3
R1
R2
R3
M2
OM
PC1
P1b
P1a
P2
P3
PC3
C3
PC2
S1
S2
S3
S4
M1
INPUT
1
CM

FIG.18

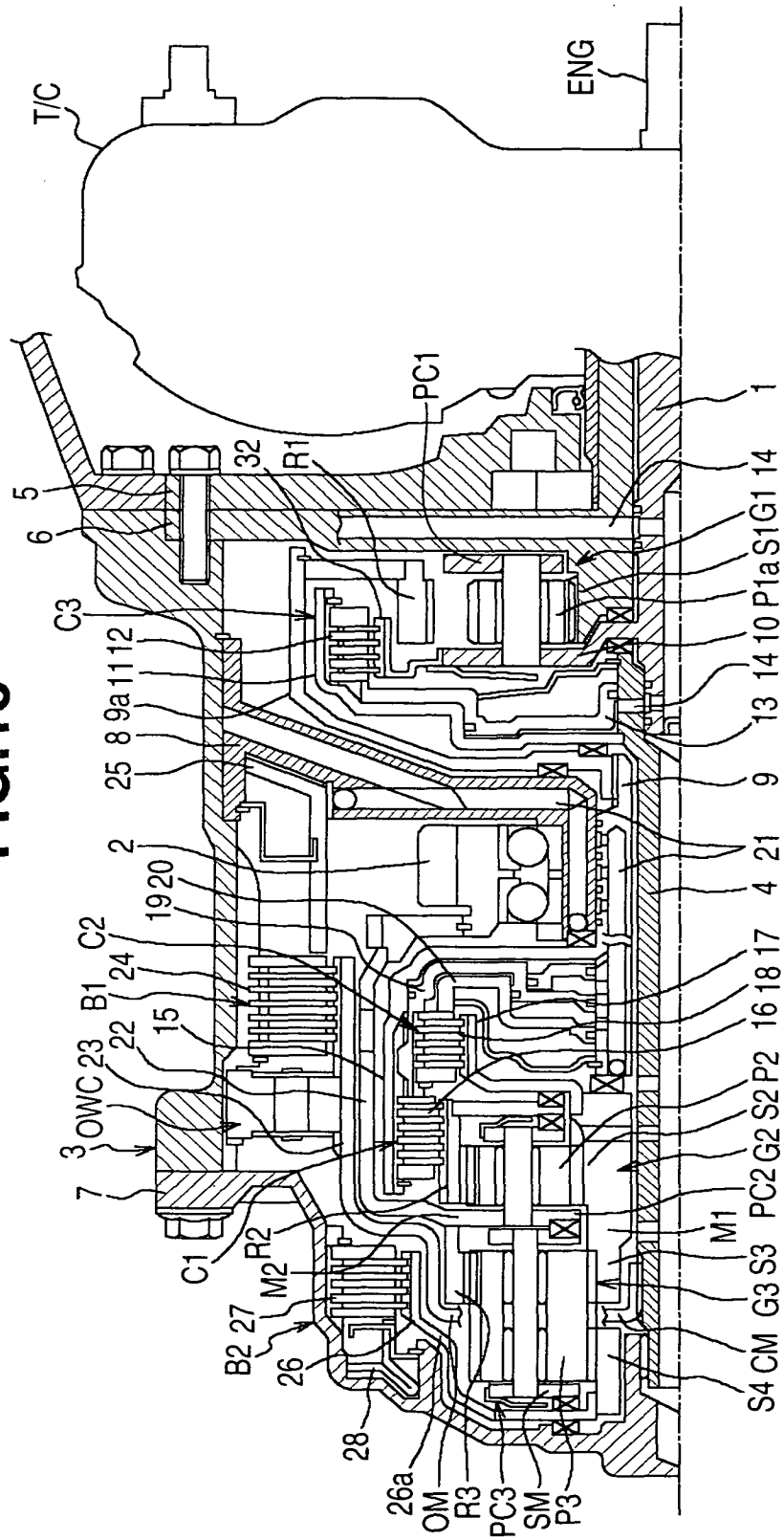

T/C
ENG
PC1
R1
32
5
6
C3
12
11
9a
8
25
2
19
20
C2
24
B1
22
15
23
OWC
3
7
C1
R2
M2
27
B2
26
28
26a
OM
R3
PC3
SM
P3
S4
CM
G3
S3
M1
PC2
G2
S2
P2
16
18
17
4
21
9
13
14
10
P1a
S1
G1
14
1

Fig. 19

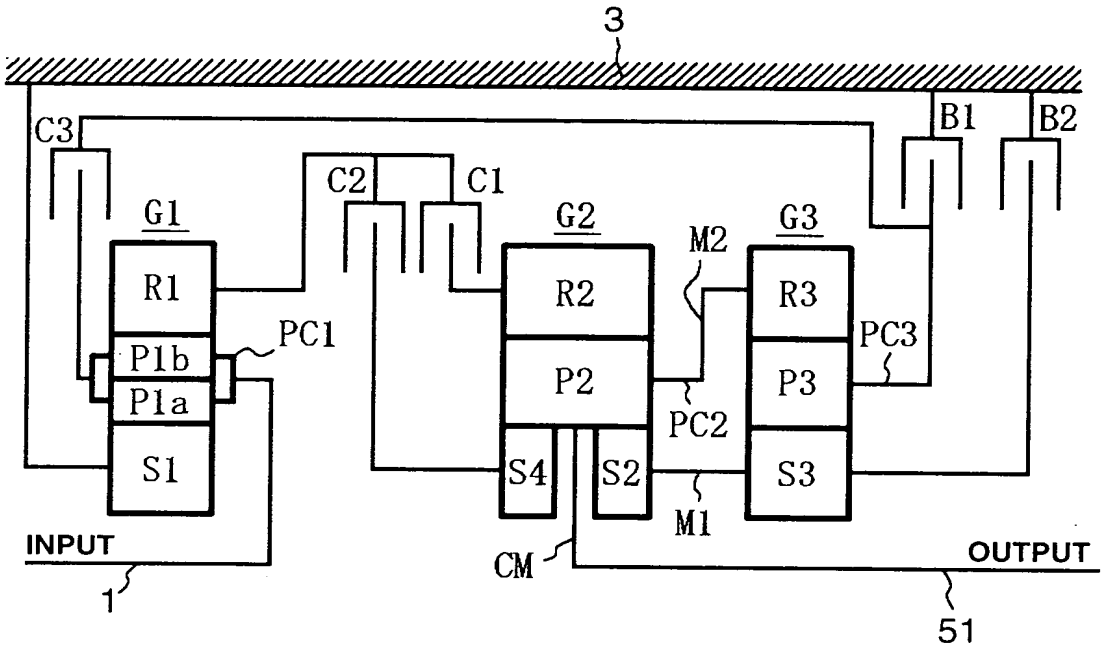

3
C3
B1
B2
C2
C1
G1
G2
G3
M2
R1
R2
R3
PC1
PC3
P1b
P2
P3
P1a
PC2
S1
S4
S2
S3
M1
INPUT
CM
OUTPUT
1
51

Fig. 20(a)

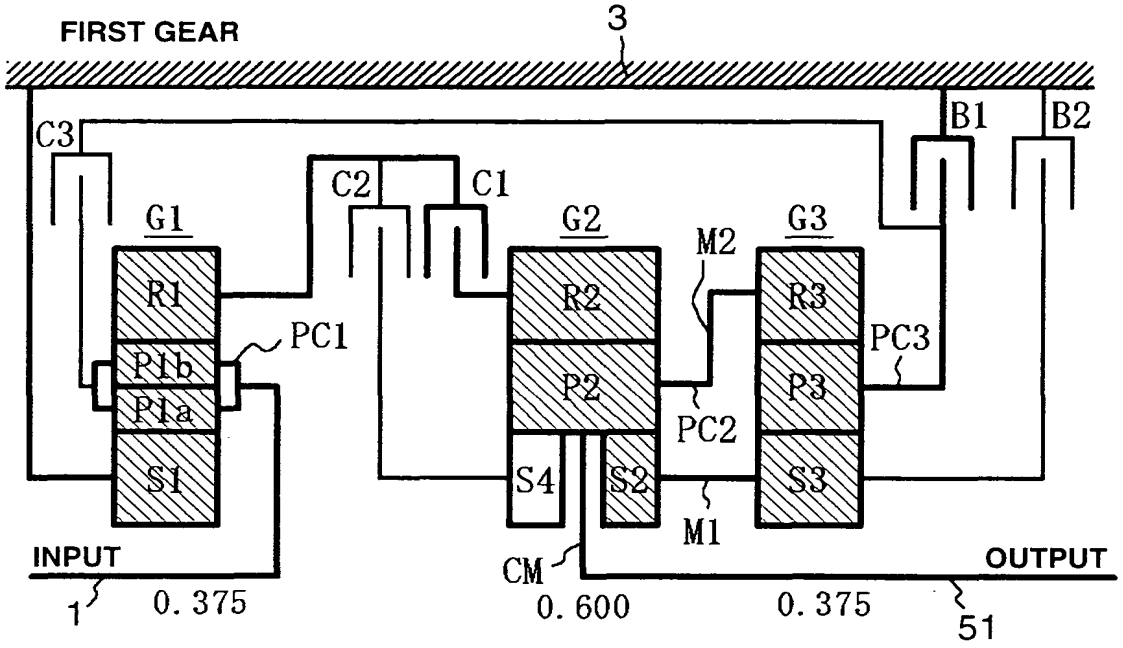


Fig. 20(b)

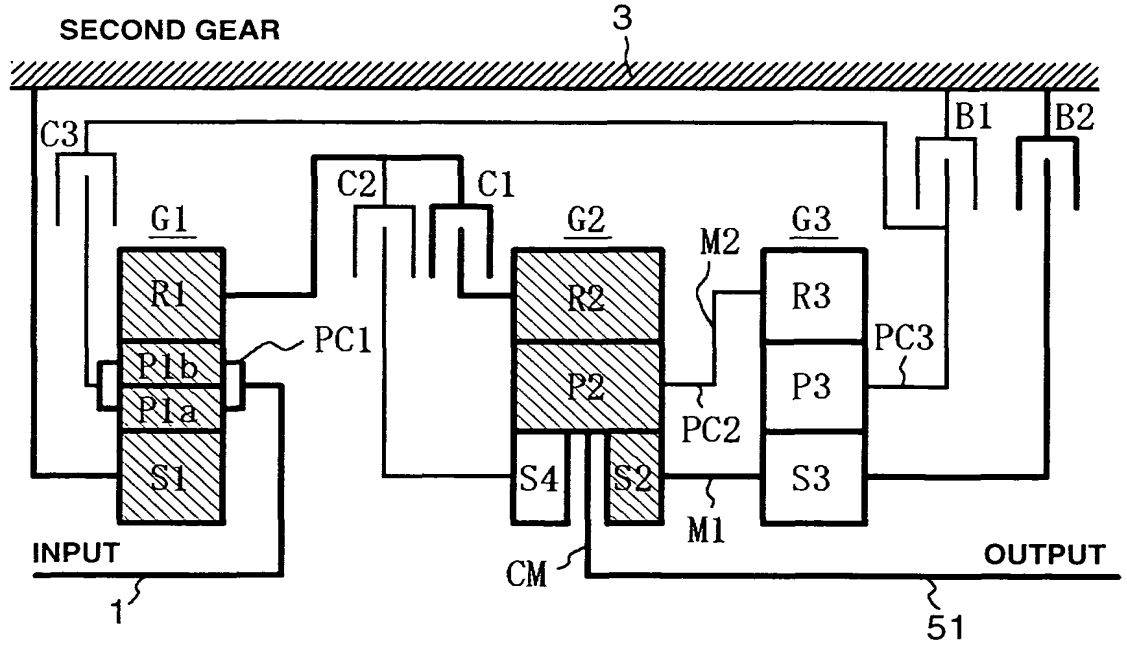


Fig. 21(a)

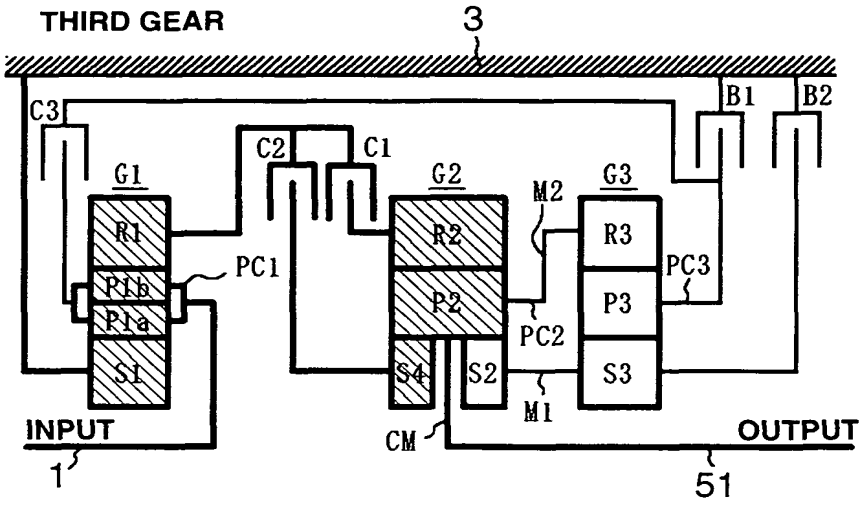


Fig. 21(b)

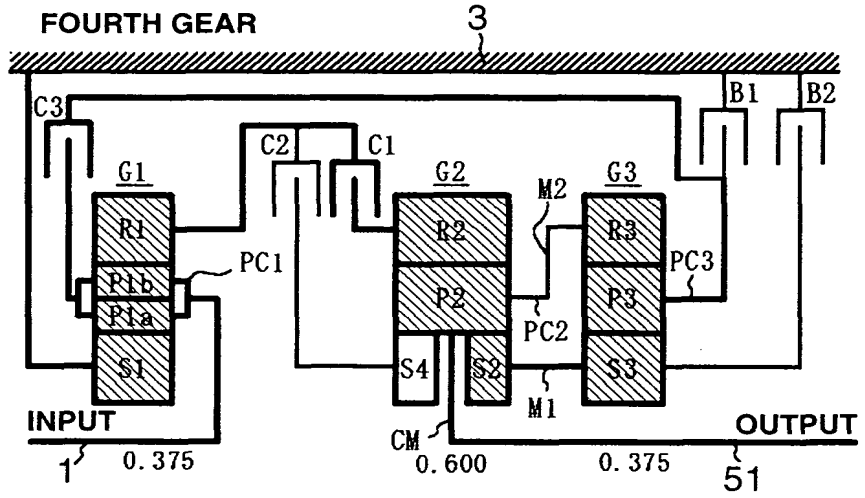


Fig. 21(c)

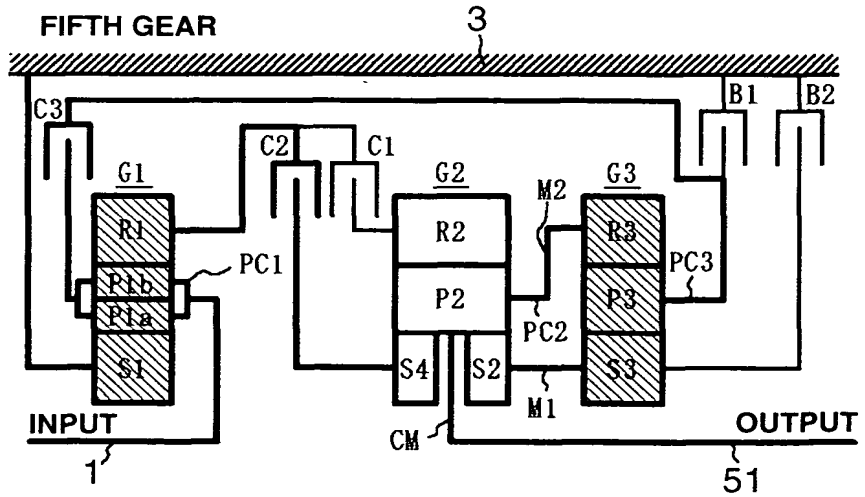


Fig. 22(a)

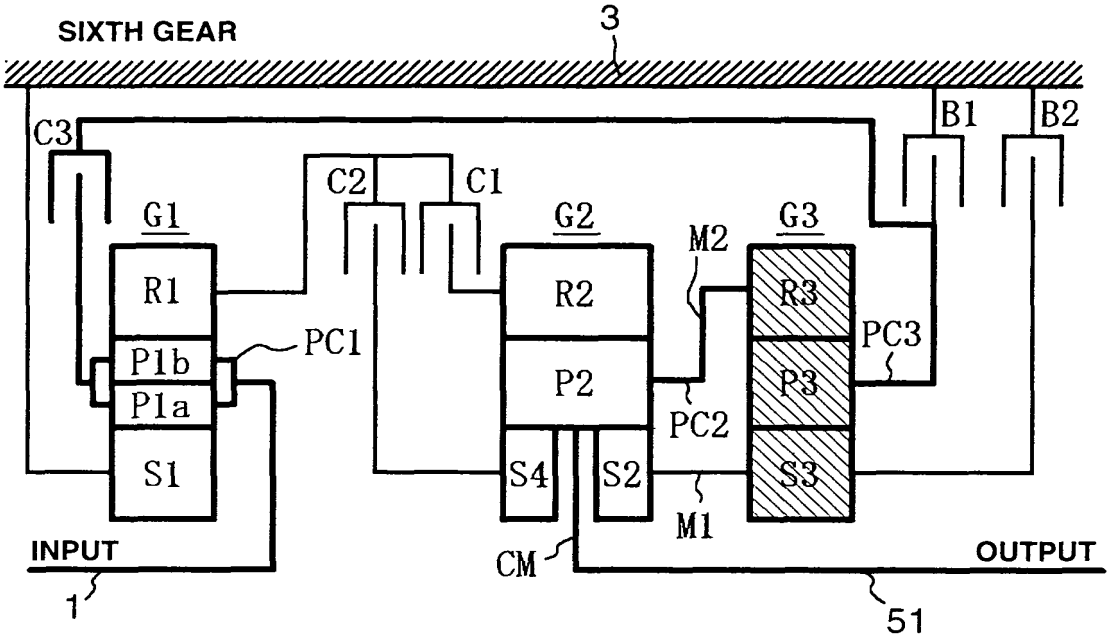


Fig. 22(b)

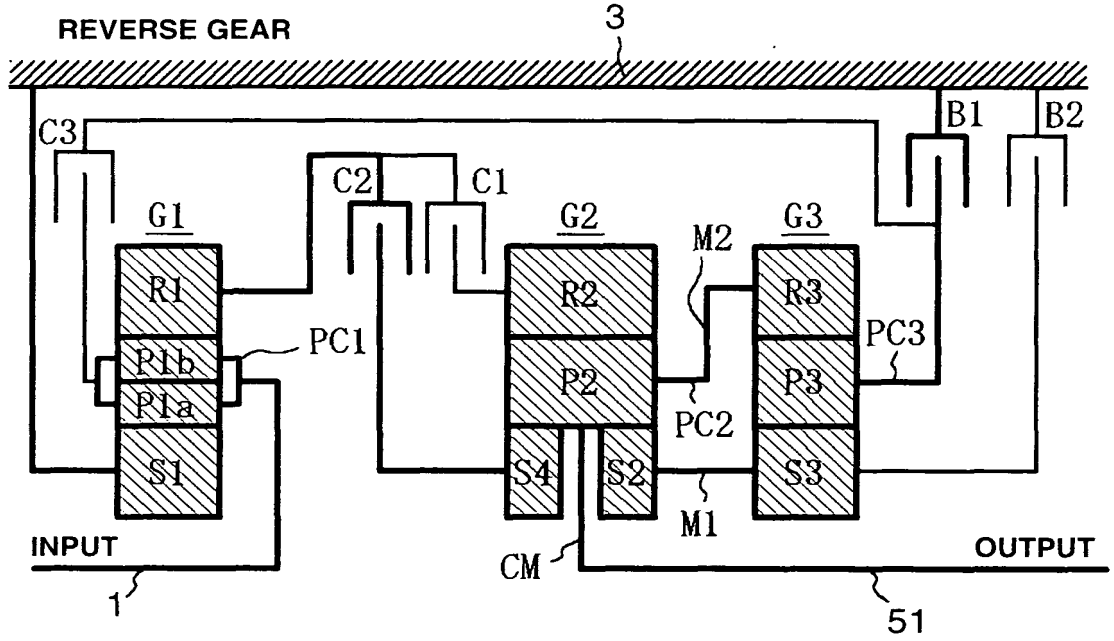
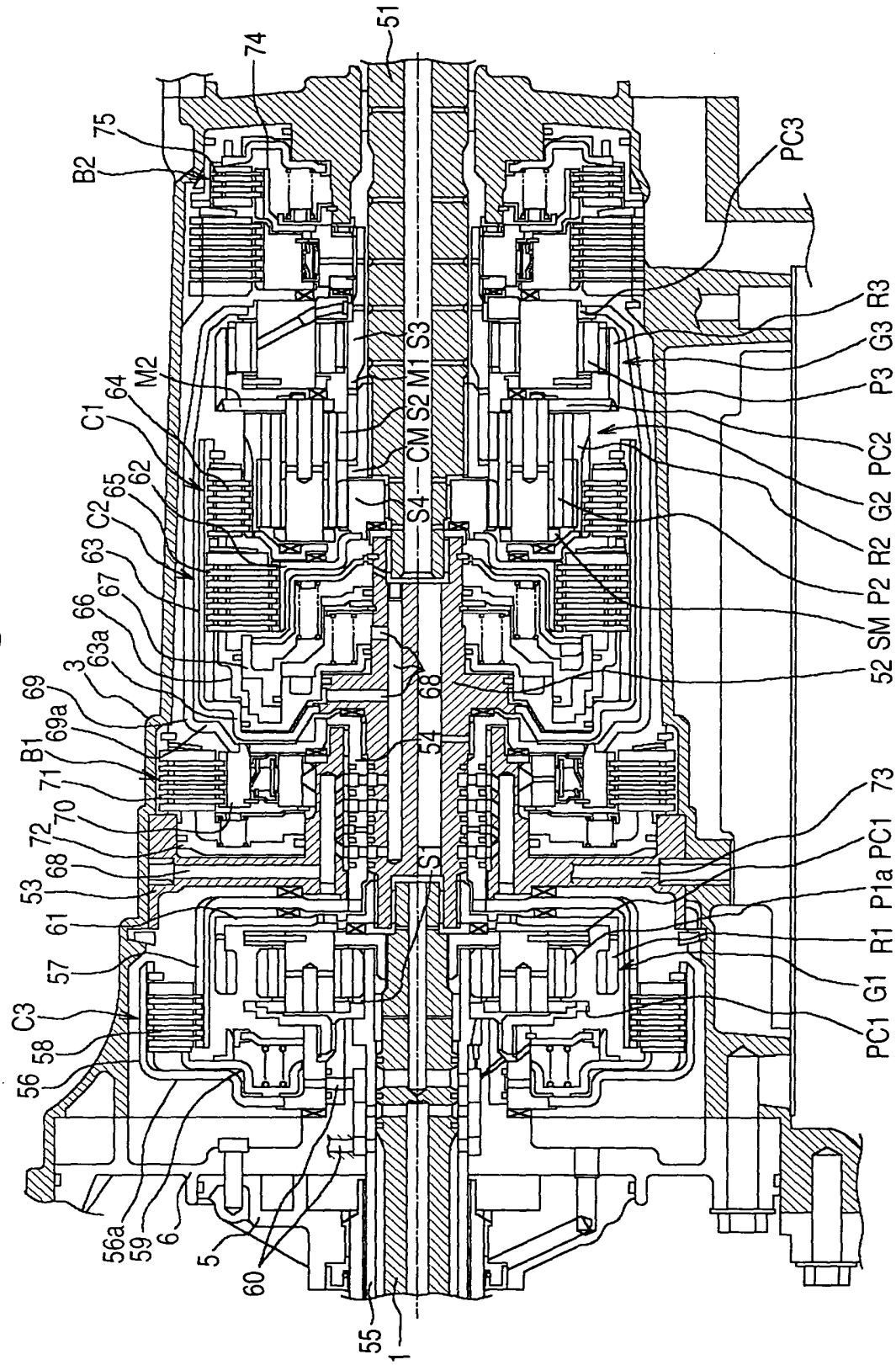


Fig. 23


51
74
75
B2
PC3
R3
G3
P3
PC2
G2
R2
P2
SM
52
64
M2
C1
62
65
C2
63
67
66
63a
3
69
69a
B1
71
70
72
68
53
61
57
C3
58
56
56a
59
6
5
60
55
1
S4
CM
S2
M1
S3
54
68
S1
73
PC1
P1a
R1
G1
PC1